

DNA Folding in Interphase

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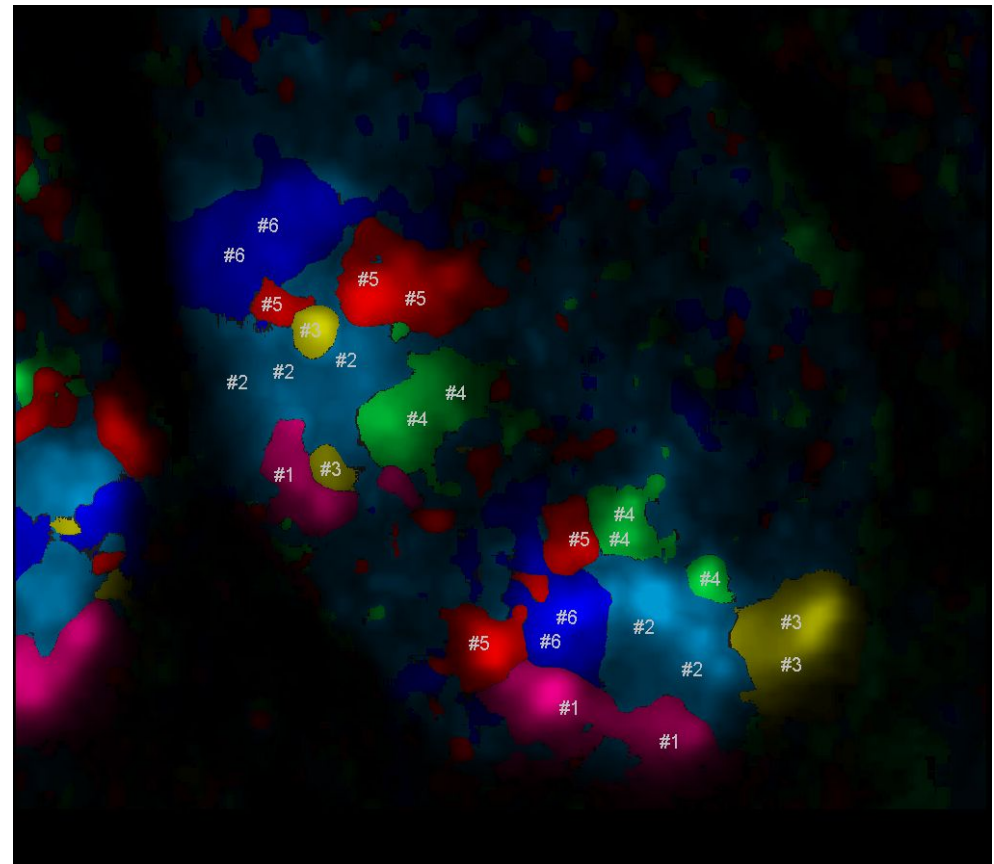
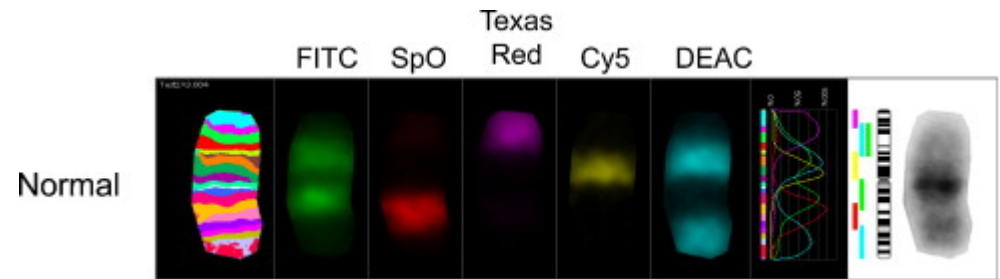
Space Radiation

SPACE LIFE SCIENCES
SUMMER INSTITUTE

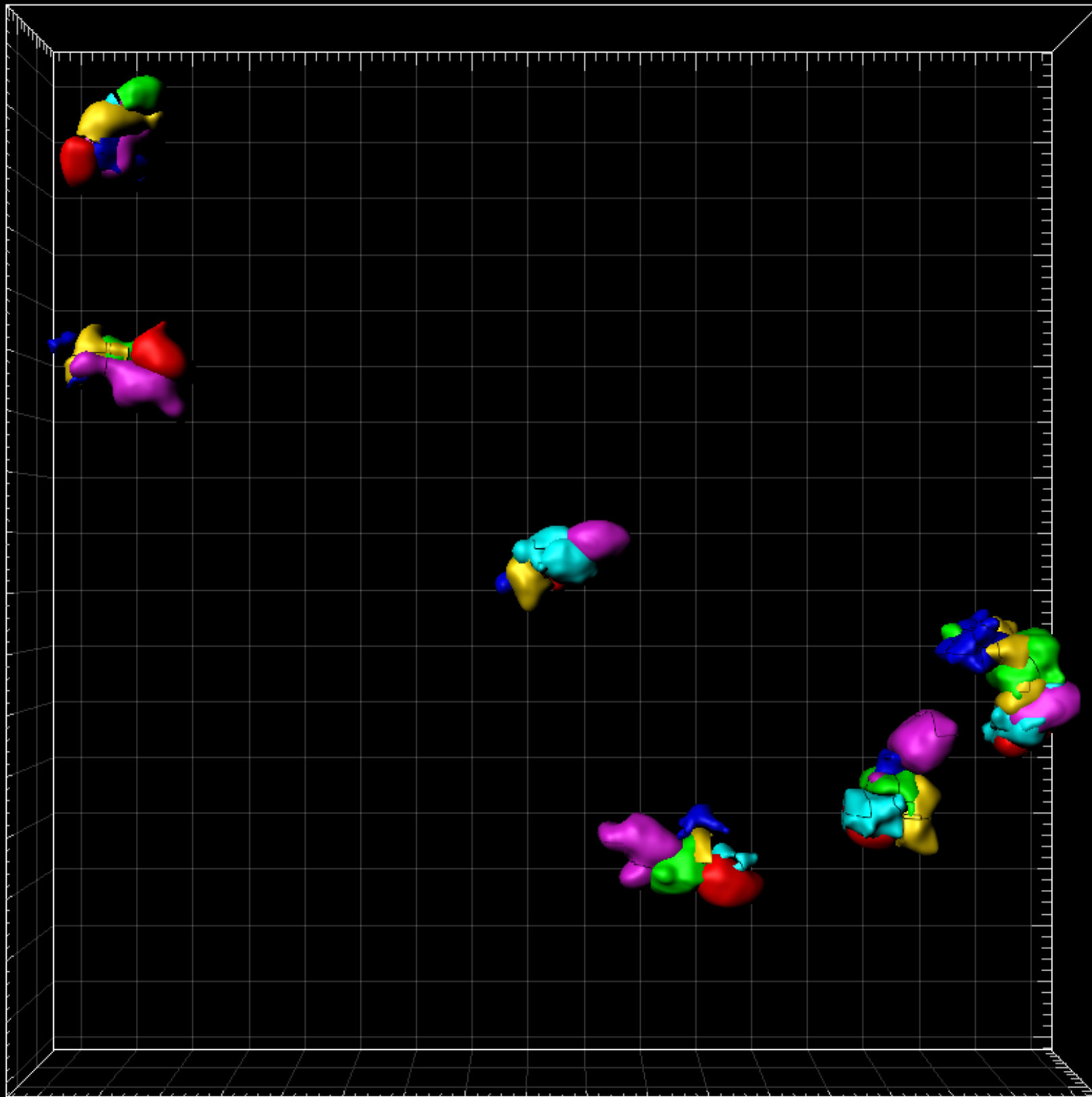


Background

- ❑ Radiation damage is one of the biggest problems in space travel
- ❑ Relative frequency of chromosome exchanges is dependent on LET
- ❑ MBand / FISH techniques
- ❑ Frequency of type of chromosome exchanges may be dependent on location



Hada M, Wu H, Cucinotta FA., mBAND analysis for high- and low-LET radiation-induced chromosome aberrations: A review. *Mutat Res*, 2011; 711(1-2): 187-192.



Threshold &
Smoothing

1

Surfacing

2

Clean-up

3

Separating
Red / Orange

4

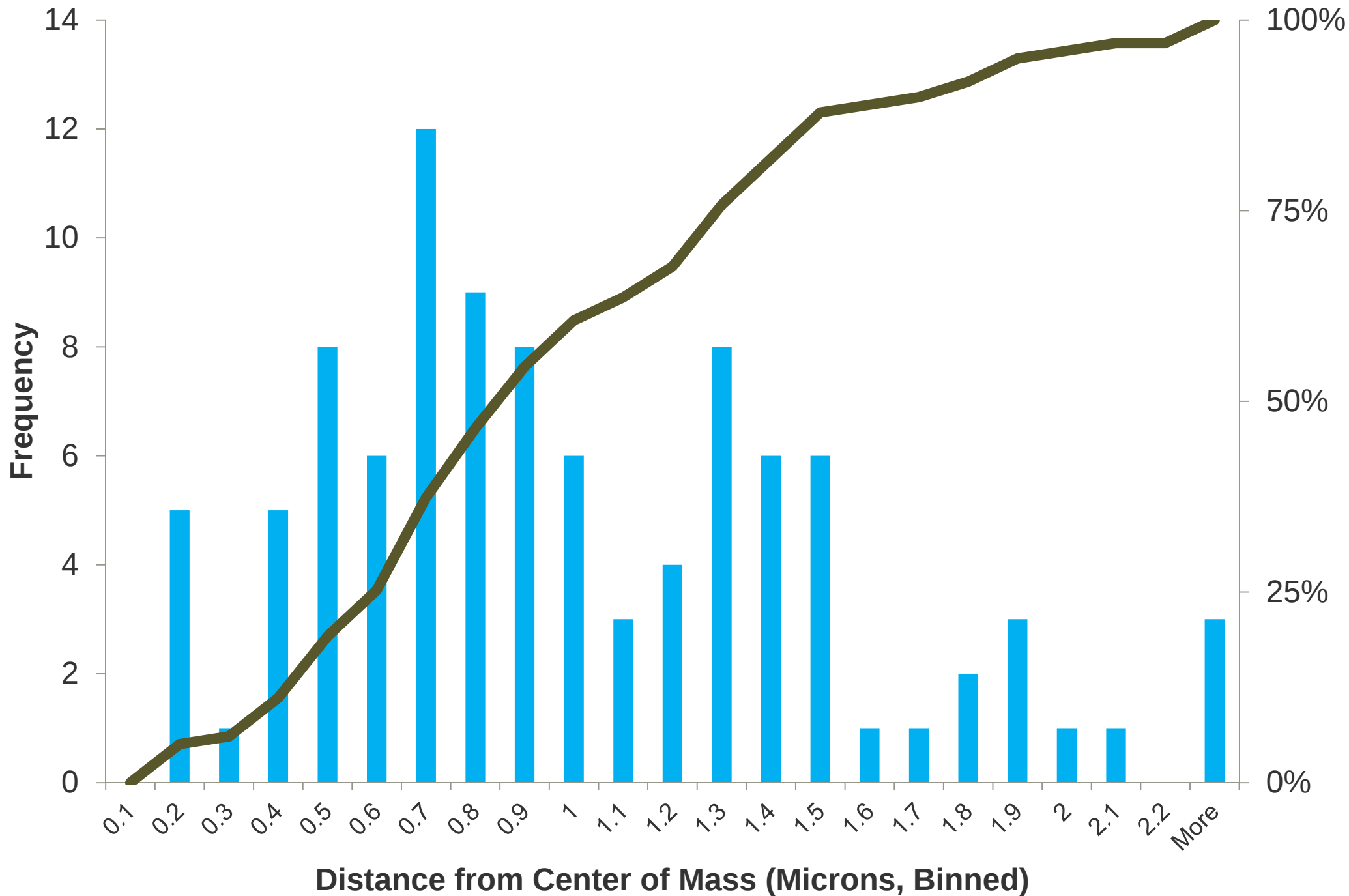
Separating
Green / Blue

5

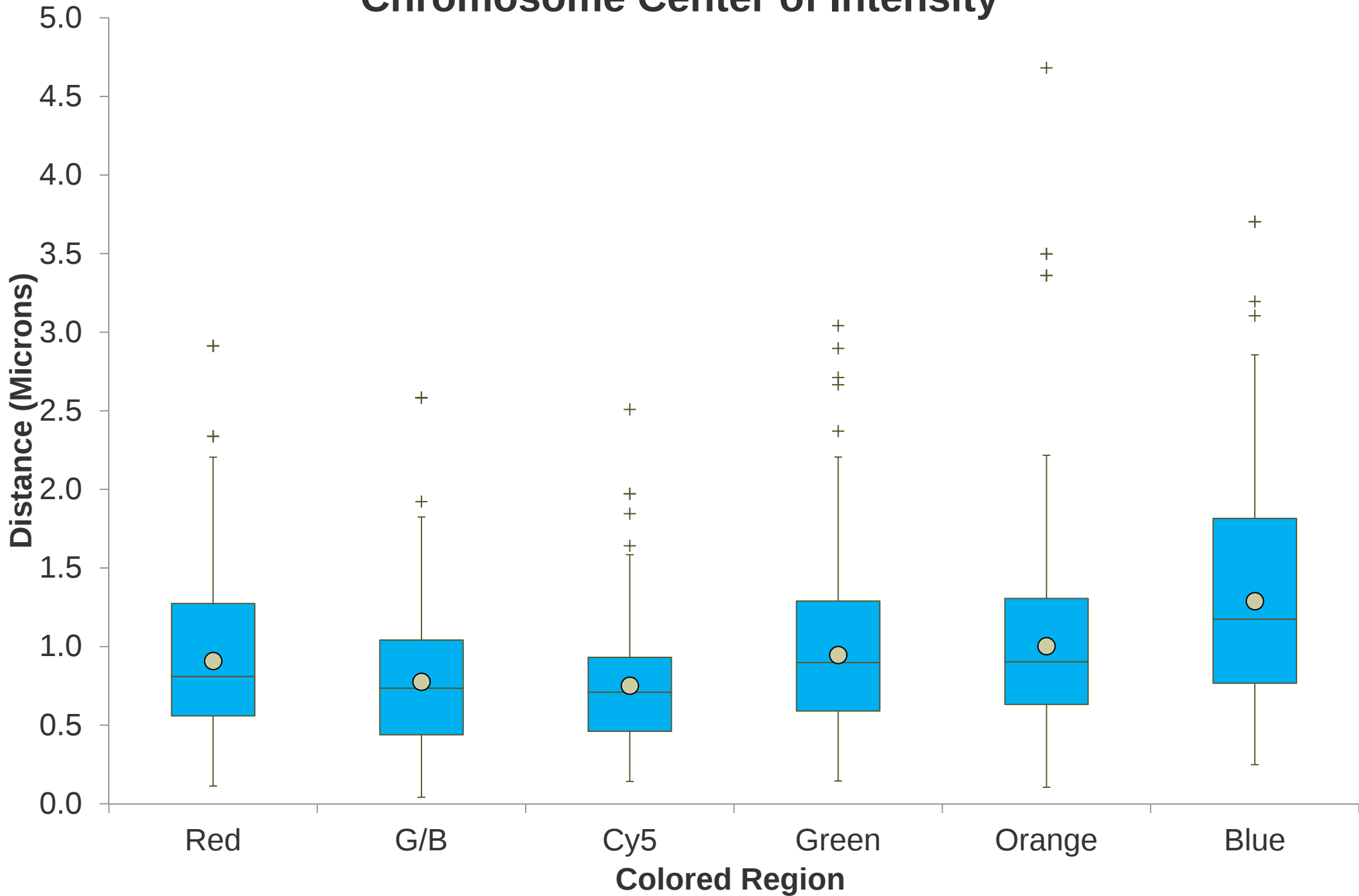
Copying Data

6

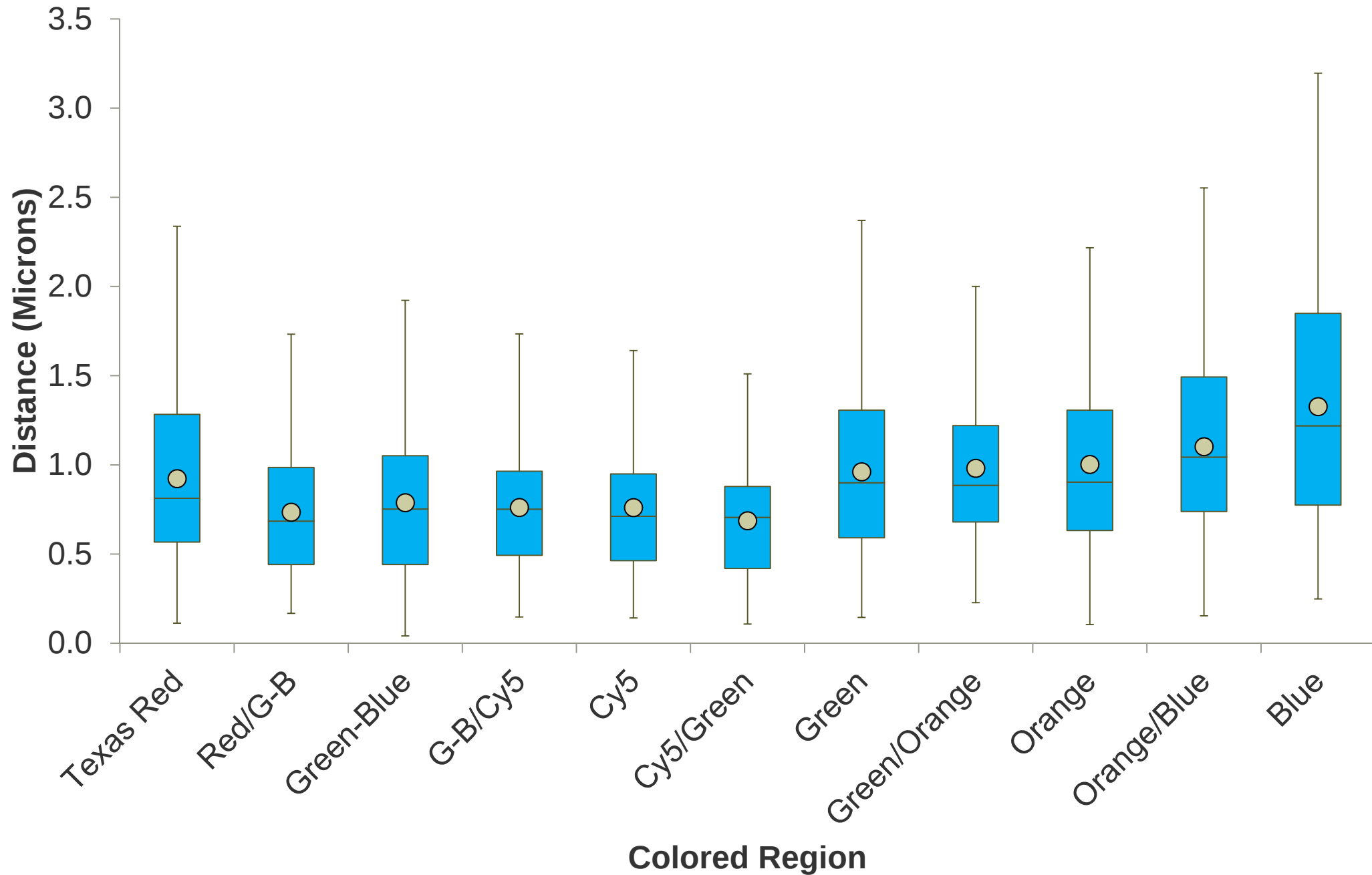
Red Region Distance to Center



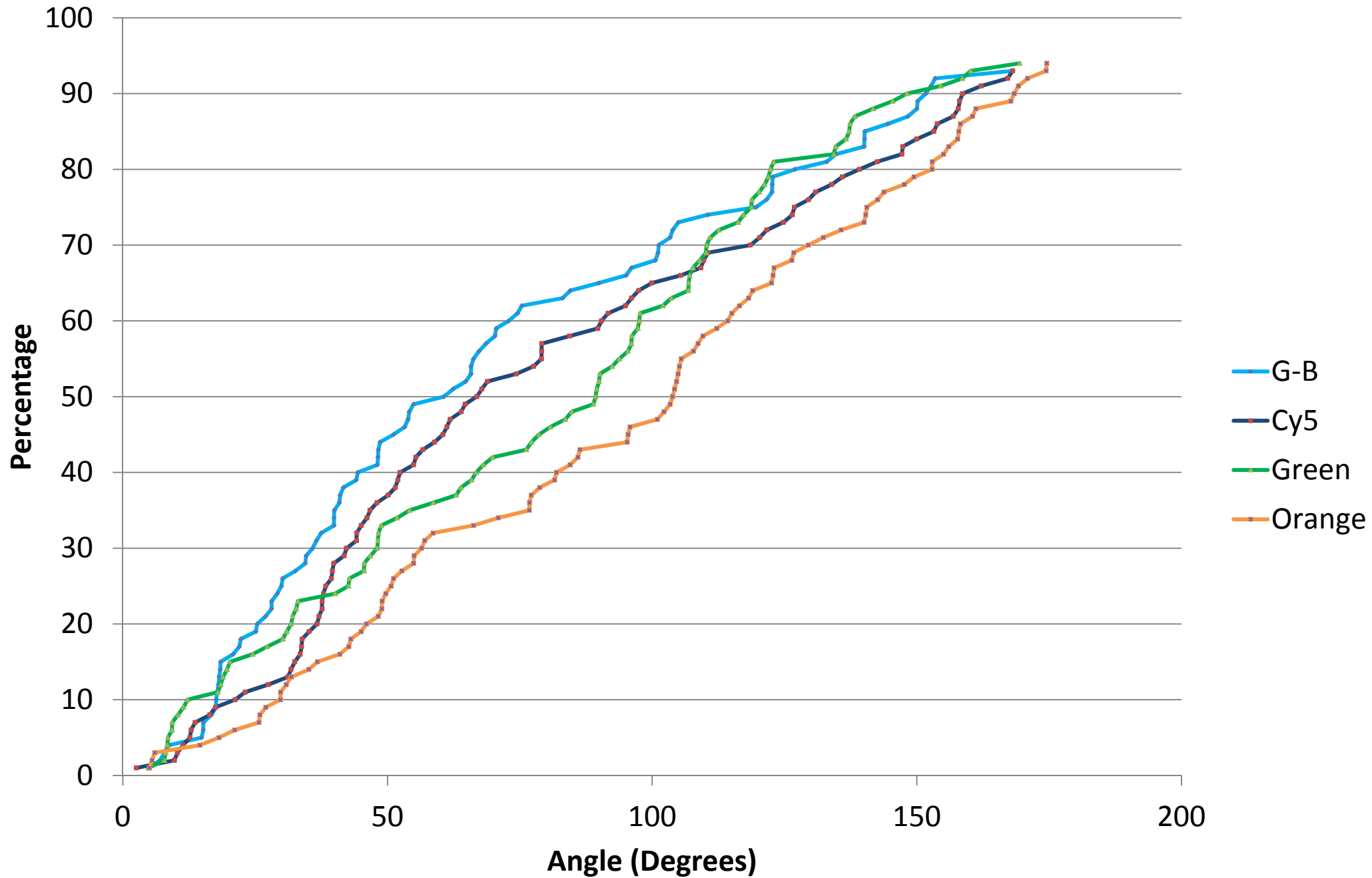
Regional Distance from Chromosome Center of Intensity



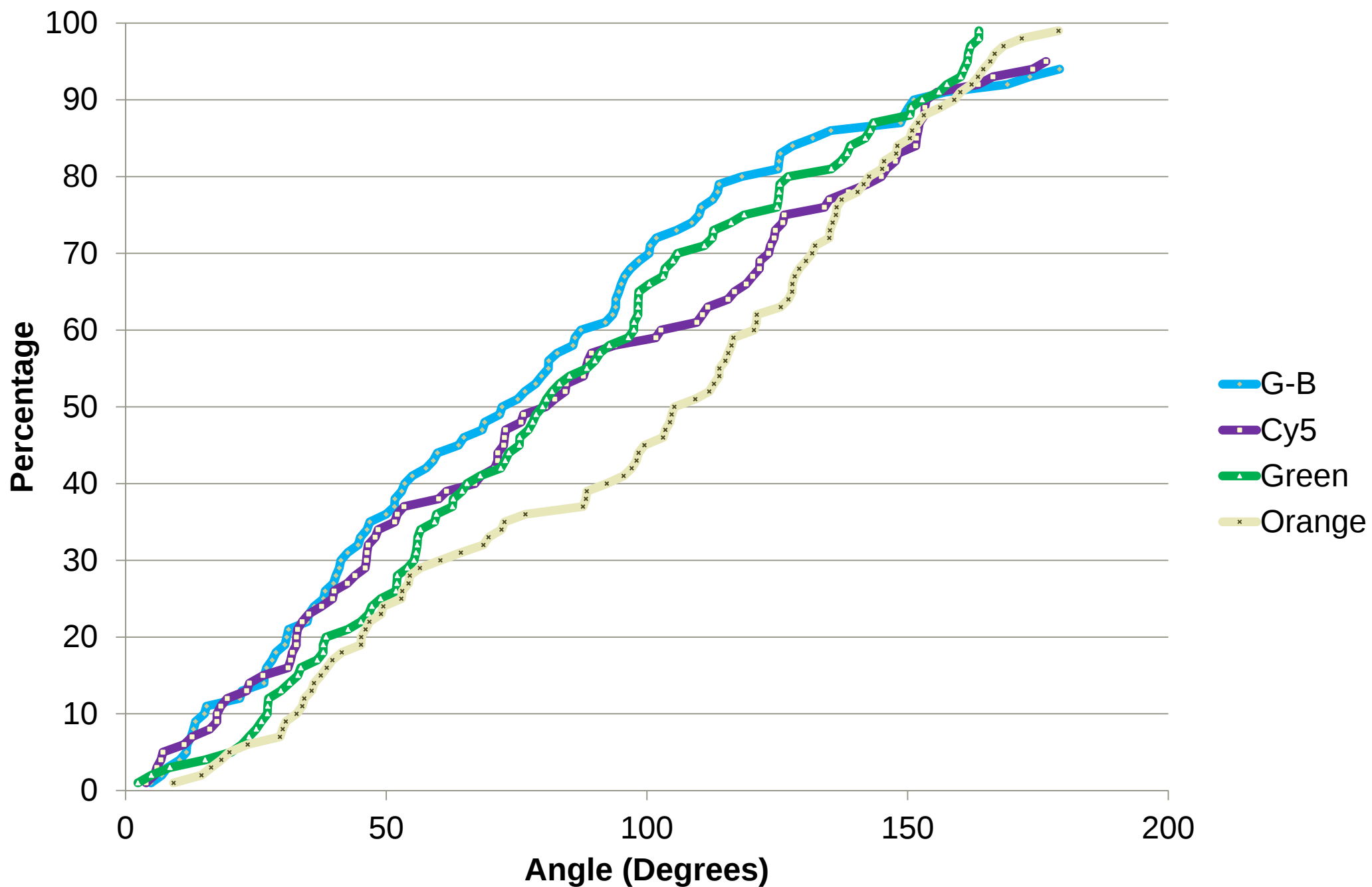
Regional Distance from Chromosome Center of Intensity



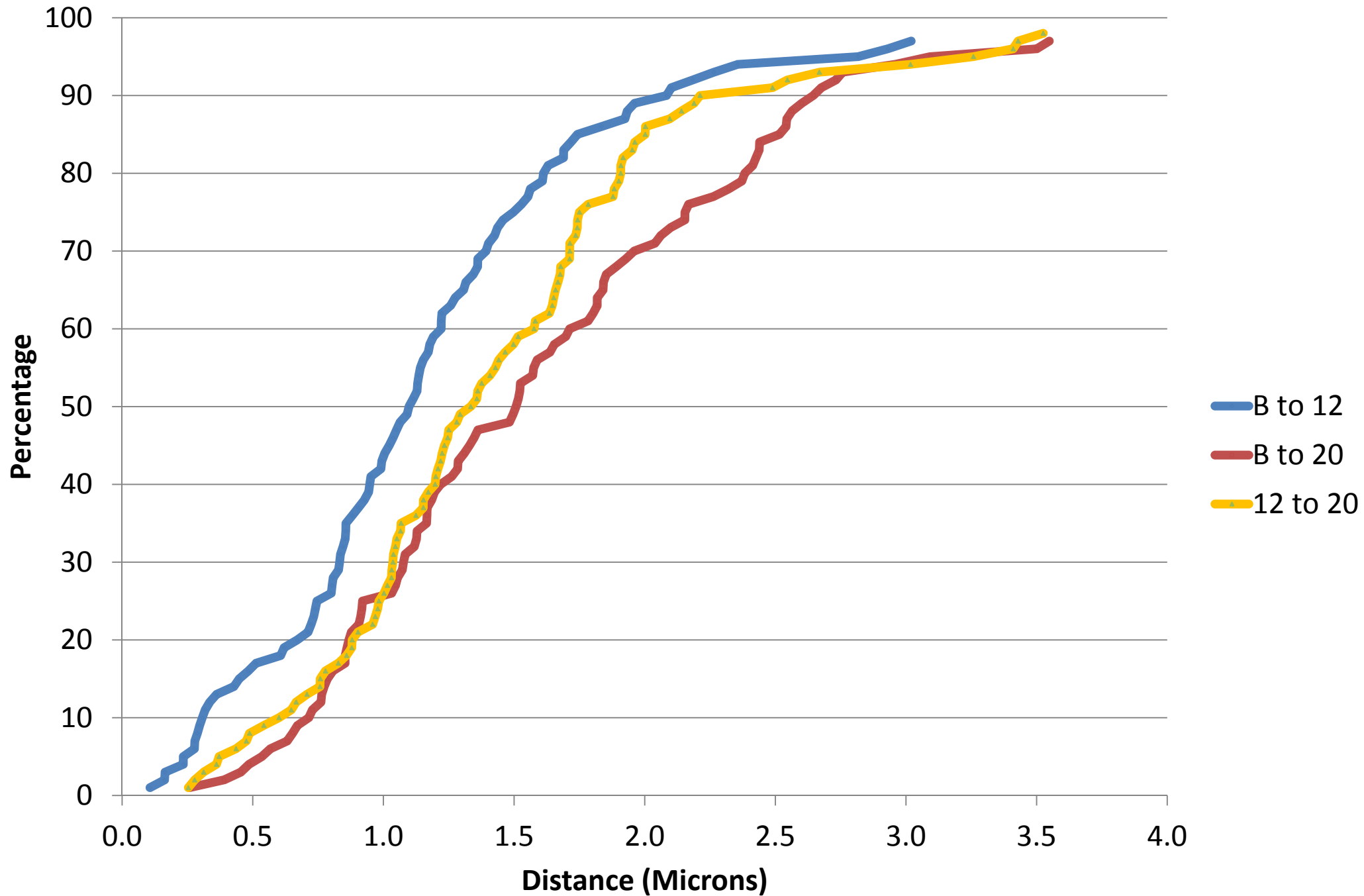
Distribution of Angles Between Regions



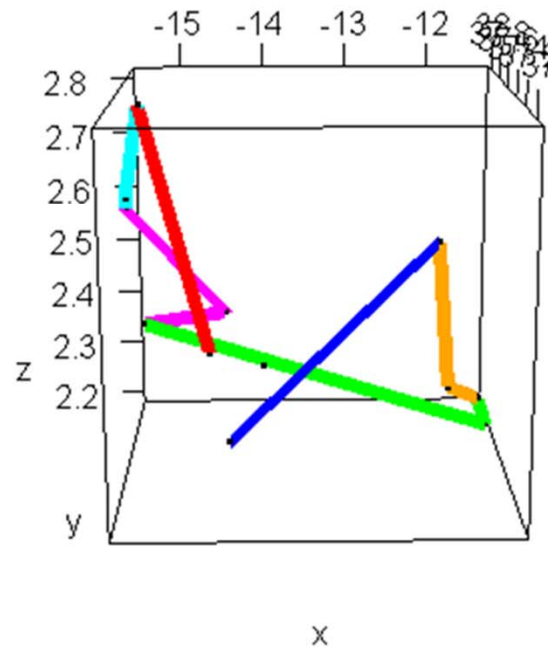
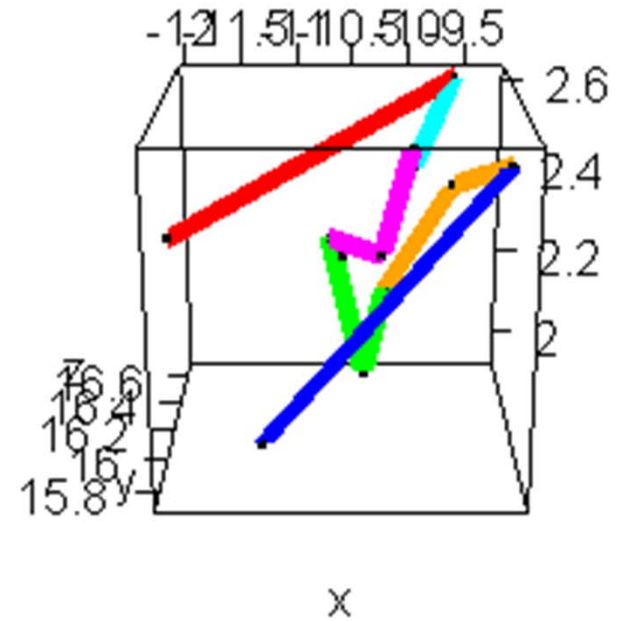
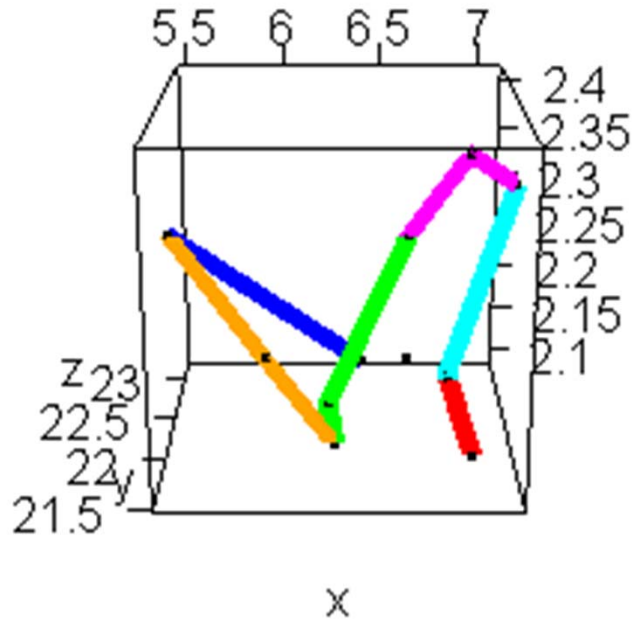
Distribution of Angles Within Regions



Distributions of Distance Between Regions B, 12, and 20

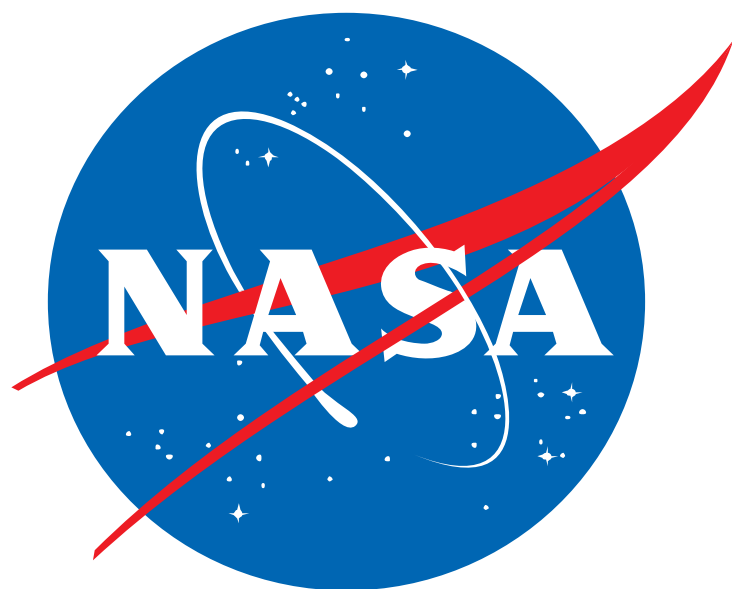


Representative Cells (all units in microns)



Discussion

- Physical location of genes contributes to the inter- versus intra-chromosome aberration ratio.
- Folding structure in interphase affects breakpoint distribution.
- The q arm on chromosome 3 has much less severe bends than the p arm in interphase.
- Gene density and transcription activity are additional factors that affect final damage distribution.
- mBAND techniques along with confocal microscopy can produce three-dimensional models of chromosomes at many stages of the cell cycle.
- A protocol for imaging and measurement of cells contributes to precise results.



Thank You!

Drs. Honglu Wu and Ye Zhang

Dr. Dipta Bandyopadhyay

Drs. Lauren Merkle and Jacqueline Reeves

Everyone in the Radiation Laboratory

Bitplane, makers of Imaris

NASA JSC and NSBRI

This work is partially funded by National Space Biomedical Research
Institute via NASA Cooperative Agreement NCC 9-58.

Introduction

- Doctoral candidate - Dr. Ford
- Researching techniques for mouse irradiation
- Looking to make space a safer place for people
- Interested in NASA for possible space living areas and travel to other planets



Objectives of Internship

- Learn about micronuclei induction
- Obtain and analyze data on depth vs. biological damage curves – ongoing...
- Learn more about various types of microscopy and MBAND
- Determine positions of various locations within interphase chromosomes using Imaris software
- Refine said into distances and angles between and within regions and their centers of mass